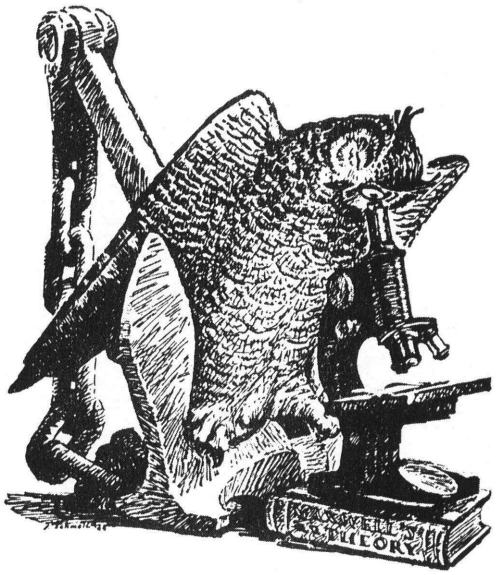

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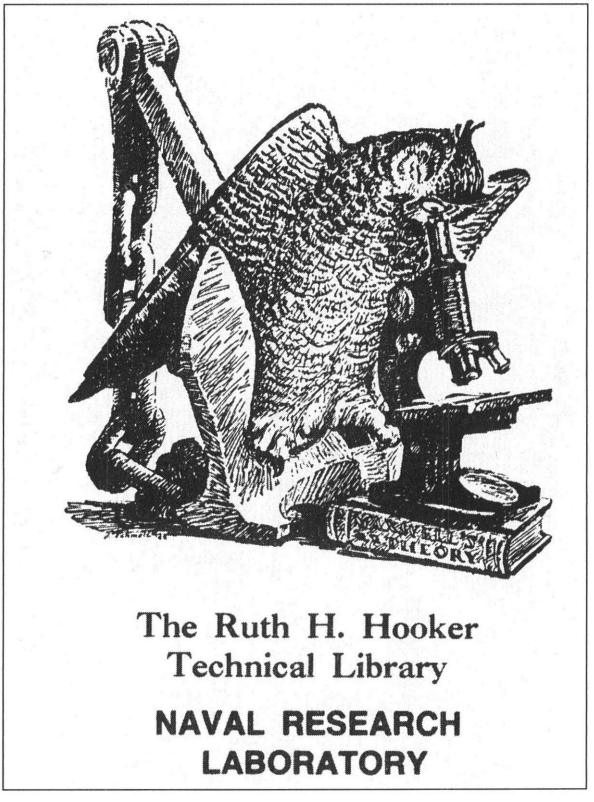

THE COVER

The bookplate (7.5 by 12.5 mm) used by the Ruth H. Hooker Research Library from at least 1946 until around 1990 was commissioned by our first librarian and library namesake, Ruth Hooker. The rich symbolism included on the bookplate captures the essence of the Naval Research Laboratory (NRL) Research Library. Specifically, the owl symbolizes the owl of Minerva, who carried wisdom back to the Roman goddess Minerva, while the anchor that the owl is standing on symbolizes both the U.S. Navy and the library's role of

Bookplate courtesy of the Department of the Navy.

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anchoring science in a changing environment. The microscope the owl is looking through signifies the basic research mission of the NRL. The book that the microscope rests on is titled *Maxwell's Theory*, symbolizing the historical collection of knowledge contained within the library's collection as well as paying tribute to the foundation of science created by James Clerk Maxwell (1831–79). As the title of his biography, *The Man Who Changed Everything* (Basil Mahon, 2003), declares, Maxwell was a nineteenth-century scientific giant who played an essential role in nearly every physical science accomplishment known today, including electromagnetic waves, heat, matter, motion, color photography, and thought experiments that influenced Albert Einstein.

Early History of the NRL and the NRL Research Library

The first steps toward the creation of the NRL started with a 1915 *New York Times* interview with Thomas Edison. Americans at the time were worried about the great European war, and Thomas Edison proposed that the nation should look to science in response, specifically stating, "The Government should maintain a great research laboratory. . . . In this could be developed . . . all the technique of military and naval progression without any vast expense." Josephus Daniels, then secretary of the navy, seized the opportunity and appointed Edison chairman of the Naval Consulting Board of the United States, the purpose of which was to study the navy's needs in this field and recommend ways to meet the need. Out of the deliberations of this board came the recommendation that there be a naval laboratory, with appropriations. The first appropriation for the constitution of the laboratory was authorized in 1916, but World War I delayed its completion until 2 July 1923. Because of Edison's influence, he is considered the "father" of the NRL and is remembered with a bust at the entrance to the library.

During the early years of the NRL, access to scientific literature was obtained and managed individually. In 1926 R. M. Langer, a scientist with leanings toward literature, was asked to survey the NRL's information needs, particularly in regard to periodicals. The "library" at that time was composed of two bookcases, and Alice Olney, secretary of the Heat & Light Division, spent part of her workday charging out books. It was then determined that in order to extract maximum benefit from the literature someone should be assigned to the library full-time. Captain Oberlin, director of the NRL, chose to employ a junior physicist, Ruth Hutchison, for this purpose, believing that someone with an understanding of the science was

more important to NRL than someone with formal library training. The assignment given to Hutchison was to "keep in touch with all research in progress and see that none of the scientists should miss related information in the literature." Hutchison started working as what was originally called a "bibliochretic" (user of books) in December 1927, personally reviewing journal articles and hand carrying them to researchers. She graduated in 1930 from George Washington University with a library science degree and was married in 1931, becoming Ruth Hutchison Hooker.

After years of focusing on the scientific literature for the direct benefit of NRL researchers, Hooker published an article in the *Review of Scientific Instruments* entitled "A Study of Scientific Periodicals," in which she examined periodical references to identify those periodicals that were most used in the fields of physics and radio.[1] Her seminal work continues to be cited today by experts in the field of bibliometrics such as Eugene Garfield, the creator of the *Science Citation Index.*

In 1935 Hooker attended her first Special Libraries Association conference and came back with a new idea: instead of individually advising the scientists of articles they should read, she would publish a bulletin that would announce all new publications as well as articles in the periodicals, giving everyone a chance to see the new literature instead of just directly notifying those to whom it was of greatest concern. This bulletin was typed on stencil and reproduced weekly, eventually becoming known as *New Research Literature.* The library's small staff and a small NRL survived the Great Depression. The staff worked four-day work weeks, and the NRL's activities were cut down to essentials, but the journal subscriptions were not cut.

The War Years

World War II brought tremendous growth to the NRL, with employment jumping from 396 in 1941 to over 4,000 in 1946. Expenditures grew from $1.7 million to nearly $14 million, the number of buildings grew from 23 to 67, and the number of funded projects grew from 200 to around 900 during those five years. The NRL Research Library also grew during this time–from a staff of two to eight, from a single room to over 9,000 square feet of space, 12,000 bound periodicals, and 200 journal subscriptions. In addition to the physical growth, services greatly expanded: the staff indexed the journal articles and growing collection of technical reports from German and Japanese researchers and assumed control over the laboratory's collection of technical reports, including the receipt of several

collections from disestablished laboratories. During the War Hooker also managed remote branch libraries in Minneapolis, Philadelphia, Orlando, New London, Connecticut, and the Chesapeake Bay Detachment and planned for the relocation of the library to larger facility–the basement of the laboratory's riverside Building 43.

The Postwar Years

After World War II U.S. and Allied researchers created a massive research institution that dramatically changed the face of warfare. Dr. Vannevar Bush, director of the Office of Scientific Research and Development, called upon men of science to make the scientific record more accessible.[2] NRL and the library were left with the task of reorganizing a hastily expanded research program and moving it back to a mix of basic and applied research projects. In 1946 the U.S. Navy had created the Office of Naval Research (ONR) as a liaison with and supporter of basic applied scientific research and had also encouraged NRL to broaden its scope and become, in effect, its corporate research laboratory. By 1946 the NRL Research Library had assumed control over the new ONR library as a remote branch library.

The NRL Research Library continued to grow and expand, with Hooker becoming very involved in the Special Libraries Association (SLA), serving as SLA president in 1949–50. In 1950 the library moved the collection of 75,000 technical reports and associated staff to the third floor of the building, expanded to 21,000 circulating books, held over 400 journal subscriptions, and had a staff of 20. In 1951, upon recommendation of the secretary of the navy, Hooker was offered the role of coordinator of naval libraries (forerunner to the librarian of the navy) and relocated to the Navy Department Library. She coordinated the efforts of the naval libraries across the country, running what would become the Consortium of Naval Libraries until 1954, when she was offered a chance to return to NRL. During this interim Mildred Benton was the chief librarian until she was moved to the role of bibliographer in 1954.

The Arrival of Computers

In 1960 the navy's inspector general recommended that NRL conduct an experiment in machine storage and retrieval of its scientific information based upon the library's indexing of over 3 million items back to 1928. The study that followed, as detailed in the March 1962 issue of *Navy Management Review*, determined that the library staff were far more efficient than the state of the art at the time (four minutes

average time compared with four hours). In 1964 Doris Baster, then head of the Documents Section, attended the "Computer Programs for Library Operations" workshop at the University of Illinois. This workshop revealed that "mechanization" had advanced to the point of encouraging the NRL Research Library to start Operation Shoestring. This project involved the production and maintenance of the journal holdings list, the journal subscription lists, and the circulation records of books and reports using punched cards. By 1964 staffing had surpassed forty, and the library had assumed control over most of the basement and the third floor of Building 43–over 25,000 square feet. Technical reports were moved back down to the basement, and the main part of the library was moved to assume control of the entire third floor. Microfilm was also introduced and deployed widely throughout the library to reduce the space taken up by the continually growing collection. After a thirty-eight-year career, Ruth H. Hooker was elected to the SLA Hall of Fame and retired in 1965, with LaVera Morgan assuming the leadership role from 1965 to 1970. In 1967 the library held 113,000 book and bound periodical volumes and 350,000 technical reports, and it subscribed to 1,800 journal titles. Manual staff indexing of journal articles was replaced with a commercial system called PANDEX in 1969. Library staff were also in the final planning stages of a new library building to be at NRL with over 65,000 square feet of space with expected completion in the early 1970s. Unfortunately, circumstances prevented the construction of the building, so the move never occurred.

During the 1970s the library switched from the Dewey decimal classification system to the Library of Congress classification. Doris Baster served as chief librarian from 1970 to 1978 and used her previous experiences with "mechanization" to move the library into the online world. This included staff access to ORBIT and DIALOG, the introduction of OCLC for shared catalog data and later for online interlibrary loans, and in 1973 direct access to the Defense Documentation Center's (now the Defense Technical Information Center) online catalog system. On 14 October 1975 Capt. John Geary dedicated the library, naming it in honor of Hooker. It thus became the first and only DoD library to be named for a living person: the Ruth H. Hooker Technical Library (now the Ruth H. Hooker Research Library).

The Online Age

Peter Imhof served as chief librarian from 1978 to 1986 and was instrumental in obtaining the library's first integrated library system in 1981. In 1983 the library became one of the first libraries in the

nation to offer both dial-in and network access to its library catalog. Imhof was promoted to head of the Technical Information Division, and Laurie Stackpole became the chief librarian in 1986. In late 1987 the Research Reports Section acquired a new integrated library system designed for the special needs of technical reports, known as Cuadra STAR. In 1988, in response to a recommendation by NRL's Computer Policy Panel, the library began lending microcomputer software to assist researchers and administrators in identifying, selecting, and using microcomputer applications. The Research Reports Section also began the conversion of its unclassified reports collection to optical storage with the development of a prototype imaging system. Subsequently, the system was modified to provide a seamless interface with Cuadra STAR, enabling researchers and staff to display full documents as part of a catalog search. This digitization effort ultimately converted 180,000 technical reports, representing over 10 million pages of content, to digital format, making the NRL Research Library one of the first and largest digital libraries in the federal arena. In 1989 the Microcomputer Software Support Center opened its doors, providing a software and hardware evaluation lab, a self-service CD-ROM search station, a scientific microcomputer software database, a laptop computer lending service, and field support of common hardware and software problems (disk recovery, virus detection/cleaning, file conversion, and software installation).

In response to a user needs assessment and NRL's network improvement plan, which called for desktop access to information stored locally and remotely, the library pioneered a telnet-based, menu-driven system known as the InfoNet. The InfoNet provided access to the online library catalog, library databases in various formats, NRL information, Gopher and Telnet sites, and internal resources. It was made available to all NRL employees, on-site contractors, off-site NRL locations, and the Office of Naval Research in August 1992. In September 1992 the library upgraded its book and journal catalog, implementing Sirsi's Scientific and Technical Information Library Automation System (STILAS). This system allowed users to perform sophisticated searches and request materials online.

The Web Era

Building upon the previous digitization experiences of the 1980s and the desktop delivery expertise established with InfoNet, the library entered a cooperative project with the American Physical Society and Los Alamos National Laboratory in 1994 to experiment with the dissemination of electronic journal information. This project

enabled NRL researchers to be the first in the world to access Physical Review E and Physical Review Letters from their desktops, clearly demonstrating the viability of electronic journals. This project also set the stage for the development of the commercial product of APS, Physical Review On-Line Archive (PROLA), as well as creating the NRL Research Library's TORPEDO (The Optical Retrieval Project: Electronic Documents Online).

Around the same time the library began experimenting with Mosaic browsers and created its first library Website, called InfoWeb, in late 1994. By 1994 the Office of Naval Research had disbanded its local library in favor of physical and digital access to the NRL Research Library, and NRL management had directed that the library provide access to its desktop offerings to all NRL sites, primarily at Stennis, Mississippi, and Monterey, California. In 1995 TORPEDO was released, providing authorized users with the ability to search the full text of the APS journal articles, technical reports, and other types of documents that the library had stored as digital images. The retrieved documents could be viewed as TIFF images online and printed locally. Access to TORPEDO was made available from end-user workstations in the library and to end-users at their desktops through the NRL network.

Following these early accomplishments, in 1995 the NRL Research Library commenced InfoVision/2000, a broad-based evaluation of the library to determine the library of the future, composed of representatives of academia, government, and the scholarly publishing community. With the InfoVision/2000 study, the NRL Research Library received clear direction and support from NRL management to shift to an environment offering Web-based and digital journals whenever possible. As a 1986 response to this directive, the library introduced a Web-based, e-mail table of contents alerting service called "Contents-to-Go" and became the first Sirsi Library Catalog site to deploy WebCat (the Web interface to the Sirsi Library Catalog). One year later, the NRL Research Library released a local installation of the Institute for Scientific Information's (ISI) Web of Science and completed its migration to a Web-based service model. Finally, in 2001 the library released TORPEDO Ultra, moving the digital content repository from TIFF (tagged image file format) to PDF (portable document format) and from Excalibur EFS (encrypting file system) to Excalibur's new concept search engine, RetrievalWare. TORPEDO Ultra was later opened up for use by over twenty government organizations, including NASA, the National Science Foundation, the Naval Postgraduate School, the National Institute for Standards and Technology (NIST), and the U.S. Naval Academy, which earned the NRL Research Library the DCI

Portal Excellence Award and the Delphi Best Practices Award in 2002. Laurie Stackpole retired as chief librarian in 2002 and was succeeded by R. James King.

The NRL Research Library now maintains a staff of 34, holds 60,000+ bound journal volumes extending back to the early nineteenth century, over 50,000 circulating books, and 1.5 million technical reports, and occupies slightly over 21,000 square feet of space, including off-site storage space for old journals. The NRL Digital Library has moved from a grand experiment to an essential part of the daily life of researchers, providing digital access to hundreds of online bibliographic database indexes, nearly 3,000 online reference tools, over 7,000 eBooks, and 3,000+ current journals, primarily from 1995 to the present. TORPEDO Ultra, the library's digital archive, now contains over 2,100 locally hosted journals from 13 publishers (Academic Press, Acoustical Society of America, American Institute of Physics, American Meteorological Society, American Physical Society, Cell Press International, Elsevier Science, Institute of Electrical and Electronics Engineers, Institute of Physics, Institution of Electrical Engineers, Kluwer Academic, Optical Society of America, and Wiley) representing over 5 million articles from 1875 to the present–one of the largest locally hosted journal collections in the country. In addition to journal content, TORPEDO Ultra also contains agency publications (technical reports, fact books, press releases, annual reviews, etc.) and NRL-authored reprints. To better manage the NRL-authored items, the library has created an online bibliography currently containing over 35,000 bibliographic records of items published by NRL researchers from 1974 to the present. This bibliography is being expanded to become the "knowledge base" of the intellectual output of the NRL from its founding, including published (journal articles, books, conference proceedings) and semipublished sources (technical reports, ePrints, presentations, etc.).

The Future of the Library

Over the next several years the NRL Research Library has six primary objectives to help position the library for the future:

1. provide rapid access to all journals, conference proceedings, and books;
2. evolve all services and products using a User-Centered Design philosophy;
3. provide a comprehensive search across all relevant scholarly communications;

4. capture the intellectual output of NRL/ONR researchers;
5. improve usage of technical reports in NRL research; and
6. move to a reliable, standards-based infrastructure.

Operating similar to amazon.com, the NRL Research Library should be able to direct users to an immediately available online article, a request for a photocopy of a local print article, or a prefilled ILL request form–essentially a single gateway to the world's collection of journal articles. Securing local hosting rights for all of the critical journals for our researchers will make it possible for them to search the full text of all of their journals at one time. Capturing conference proceedings will allow researchers to find and retrieve these hard-to-find items. Interfaces must be designed in a way that works the way researchers look for proceedings. Local hosting will ensure permanent access to these resources, and leveraging the sponsorship that ONR provides for several of these conferences will allow the library to obtain many proceedings from a wide range of publishers at no cost.

Many of the services and collections developed by libraries have traditionally been done in a vacuum with little input from the user community until the product has been created. The NRL Research Library plans to take advantage of the extensive research being done in interaction/interface design and usability as well as the wealth of usage statistics gathered over the past several years and researcher interactions to make online systems more usable and functional.

Providing access to over 100 bibliographic indexes creates a problem of knowing which index to use for a specific search. Researchers are increasingly calling for a single search across all of the relevant indexes. The NRL Library has partnered with several A&I services to aggregate the core indexes into a single interface or set of interfaces to reduce the burden upon researchers and improve literature searches through a broader search.

Much hype surrounds knowledge management, but at its roots is a desire to manage a new format of information, unpublished corporate material. Libraries have worked out detailed, solid processes for validating and managing published information but do not have a handle on internally produced materials. The NRL Research Library will be expanding the online bibliography to include semipublished and unpublished materials generated by researchers that contain scholarly value. In addition, new workflows are being devised to ensure that all "born digital" materials are captured rather than being converted.

Disciplines that are more applied at NRL may not be able to publish their findings in traditional journals or conference proceedings due to their sensitive nature. A classified Digital Library is being created to help manage and provide access to this wealth of information, which is not easily accessible. In addition, the library is working to infuse unclassified technical report literature into more of the research process to ensure that lessons learned in the past are not unnecessarily repeated.

By supporting the latest standards such as J2EE, OpenURL, Open Archives Initiative, and the Open Archival Standard the library will be well positioned to evolve with future changes to the Web environment. Increasing the reliability and protection of the library's physical and digital infrastructure is also planned.

The rich symbolism of the NRL Research Library's bookplate still resonates today. The library has been on the cutting edge of library science for decades, applying technology and resources to assist the NRL researcher to have the best possible information as quickly as possible. Aggressively evolving into the digital age will ensure that the Ruth H. Hooker Research Library exists well into the future.

R. James King, Chief Librarian, Naval Research Laboratory, Ruth H. Hooker Technical Library

Notes

1. Ruth Hutchison Hooker, "A Study of Scientific Periodicals," *Review of Scientific Instruments* 6 (1935): 333–38.

2. Vannevar Bush, "As We May Think," *Atlantic Monthly* 176, no. 1 (July 1945): 101–8, http://www.theatlantic.com/unbound/flashbks/computer/bushf.html.